National Institute of Environmental Health Sciences

Spatial- and time-explicit human damage modeling of ozone depleting substances in life cycle impact assessment

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Abstract:

Depletion of the stratospheric ozone layer is mainly caused by emissions of persistent halocarbons of anthropogenic origin. The resulting increase of solar ultraviolet radiation at the Earth's surface is associated with increased exposure of humans and increased human health damage. Here we assessed the change in human health damage caused by three types of skin cancer and cataract in terms of (healthy) years of life lost per kiloton emission reduction of an ozone-depleting substance (ODS). This so-called characterization factor is used in Life Cycle Assessments (LCAs). Characterization factors are provided for the emissions of five chlorofluorocarbons, three hydrochlorofluorocarbons, three (bromine-containing) halons, carbon tetrachloride, methyl chloroform, and anthropogenic emissions of methyl bromide. We employed dynamic calculations on a global scale for this purpose, taking physical and social geographic data into account such as skin tones, population density, average age, and life expectancy. When emission rates of all ODSs in 2007 are multiplied by our characterization factors, the resulting number of years of life lost may be a factor of 5 higher than reported previously. This increase is merely explained through the global demographic development until 2100 we took into account.

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Resource Description

Exposure :

weather or climate related pathway by which climate change affects health

Ecosystem Changes, Food/Water Quality, Food/Water Security

Food/Water Quality: Chemical, Other Water Quality Issue

Water Quality (other): urban and rural run-off;dissolved oxygen

Food/Water Security: Fisheries

Geographic Feature:

resource focuses on specific type of geography

Freshwater, Rural, Urban

Geographic Location:

resource focuses on specific location

United States

Health Impact:

specification of health effect or disease related to climate change exposure

Health Outcome Unspecified

Mitigation/Adaptation:

mitigation or adaptation strategy is a focus of resource

Adaptation

Model/Methodology:

type of model used or methodology development is a focus of resource

Exposure Change Prediction, Methodology, Other Projection Model/Methodology

Other Projection Model/Methodology: regional River Invertebrate Prediction and Classification System (RIVPACS) model; and Weight of Evidence Method

Resource Type:

format or standard characteristic of resource

Research Article

Timescale:

time period studied

Time Scale Unspecified

Vulnerability/Impact Assessment:

resource focus on process of identifying, quantifying, and prioritizing vulnerabilities in a system

A focus of content